SECTION IV.—RIVERS AND FLOODS.

RIVERS AND FLOODS, FEBRUARY, 1915.

By ALFRED J. HENRY, Professor in charge of River and Flood Division.

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The flood situation during February, 1915, became threatening in the Ohio Valley during the first week of the month, due to the combination of warm weather, and fairly heavy rains on a snow cover of several inches. The latter, during the closing week of the previous month ranged in depth from 3 to 12 inches over the northern tributaries in the upper portion of the watershed. The States of Kentucky and Tennessee were bare of snow with the possible exception of the northern slopes in mountain districts.

A low-pressure system advanced upon the Ohio Valley on January 30, 1915, causing a rise in temperature and precipitation in the form of rain in the lower portion of the watershed. The rain continued and became considerably heavier on the succeeding day and a pronounced rise in temperature over the northern tributary streams in Ohio and Indiana caused a large run-off from melted snow. The breaking up and gorging of the ice threatened serious damage at various points and it was deemed necessary to destroy ice gorges by the use of dynamite at several places. The advance of the low pressure system to the northeastward was retarded and thus precipitation which ordinarily is concluded within 36 hours persisted throughout the 1st and for a portion of the 2d, and in West Virginia on the 3d. By this time a second low-pressure system was approaching from the west. Precipitation from this second storm was in the form of rain, which began on the lower portion of the watershed on the 4th and passed beyond the upper portion on the 6th.

The flood wave was created by the heavier rains of January 31 and February 1, combined with the run-off from melting snow. It was not greatly affected by the second period of rain. In the upper reaches of the river, as at Pittsburgh, the stream rose rapidly in the 24 hours following 8 a. m. of the 1st. At that hour the stage was 4.5 feet; and at 8 a. m. of the 2d the stage was 23.7 feet, a rise of 19.2 feet. The crest of the wave was not reached until midnight of the 2d, 28.4 feet, or 6.4 feet above flood stage. The progress of the flood wave down stream is shown in the subjoined table.

It will be noticed that the lower portion of the river, as at Evansville, was in flood as early as the 3d and that it continued in flood throughout the period covered by the table. The river at Cairo passed the flood stage on the 9th and fell below again on the 15th. The flood, therefore, in the upper stretches of the river was of much less duration than in the lower portion of the river.

The flood thus described passed into the Mississippi beginning on the 9th. At that time the Mississippi, which, in the neighborhood of Cairo, was rising somewhat from the same causes that had produced the Ohio flood, was still almost 10 feet short of flood stage, and hence conditions were unfavorable for a great flood. The river at New Madrid, Mo., the first station on the Mississippi below Cairo, passed the flood stage on the 19th. At Memphis, the flood stage, 35 feet, was reached on the 13th; the crest stage of 36 feet on the 17th and 18th, falling below flood stage on the 22d. At Vicksburg, Miss., the river lacked 1.2 feet of flood stage at the close of the month. The crest stage, 44 feet, flood stage 45 feet, was reached on March 1, and with a falling river thereafter the menace of a flood in the lower Mississippi in the spring of 1915 largely disappeared.

The rains of the last few days of January and early in February also produced flood stages locally in the rivers of the Carolinas, the James River of Virginia, the rivers of southeastern Mississippi and northern Alabama; also freshet stages in the White River of Arkansas, the Grand River of Missouri, and the Illinois. The rivers of Michigan also reached freshet stages during the month, due mostly to the formation of ice gorges and the melting of snow.

During the closing week of the month a local flood occurred in the Mississippi River between Quincy, Ill., and Hannibal, Mo., due to the melting of snow in the Des Moines Valley; also in the last part of the month a moderate flood occurred in the Connecticut River and the smaller streams of northern New England, due to a short, rainy period in conjunction with the melting of the snow cover and the breaking up of the ice in the streams.

TABLE 1.—*Daily gage readings (feet) during Ohio flood of February, 1915.*

Station.	Flood stage.	February, 1915.																Crest.		
		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Stage.	Date.	Hour.
	Feet.																	*Feet.*		
Pittsburgh	22	23.7	27.7	19.5	14.2	11.9	11.3	9.9	8.4	6.8	5.6	5.2	5.7	9.0	11.0	14.8	14.4	28.4	3	12:30 a. m.
Wheeling	36	20.6	39.7	**41.0**	34.0	25.3	20.5	18.3	15.8	13.3	11.3	10.3	10.0	12.0	16.2	19.2	23.0	42.2	3	10:00 p. m.
Parkersburg	36	26.5	34.7	41.0	**42.0**	38.6	33.7	27.6	22.4	18.1	15.0	12.7	12.0	12.9	15.9	19.3	21.8	42.2	4	9:10 p. m.
Point Pleasant	40	27.9	39.9	47.4	**49.8**	44.1	40.7	42.2	37.3	29.4	23.3	18.6	15.4	14.6	15.8	18.7	22.6	49.8	5	7:31 a. m.
Huntington	50	28.9	39.7	47.4	50.6	**51.1**	50.0	47.1	42.3	36.0	29.2	23.4	19.1	17.3	17.8	20.0	23.5	51.1	6	8:00 a. m.
Catlettsburg	50	32.0	42.6	50.1	53.5	**54.1**	53.0	50.2	45.4	39.3	32.1	26.0	21.7	19.3	19.8	22.3	25.9	54.2	6	9:00 p. m.
Portsmouth	50	32.0	41.0	48.5	52.6	54.4	**54.5**	53.0	49.7	44.1	37.3	30.6	25.2	22.5	22.4	24.0	26.4	54.7	6	2:00 p. m.
Maysville	50	29.7	37.7	44.7	49.5	52.5	**53.4**	52.6	50.3	46.1	40.6	34.4	28.2	23.8	22.4	22.9	24.9	53.5	6	10:00 p. m.
Cincinnati	50	38.0	41.4	45.2	49.5	54.3	**55.8**	55.5	54.0	51.0	46.6	40.8	34.8	29.8	26.3	24.9	25.6	55.9	7	8:20 a. m.
Louisville	28	15.7	19.6	21.0	22.7	25.6	28.3	29.8	**29.9**	28.9	26.7	23.2	18.3	13.2	10.7	10.0	9.7	29.9	9	7:00 a. m.
Evansville	35	31.9	35.0	37.0	38.3	39.2	40.1	41.0	41.9	42.5	**42.6**	42.5	41.9	40.9	39.4	36.9	33.6	42.6	11	7:10 a. m.
Cairo	45	35.0	37.1	39.1	41.2	42.7	43.8	44.4	45.0	45.3	**45.6**	**45.6**	**45.6**	45.3	44.8	44.0	43.0	45.6	.....	

Considerable loss was sustained at a number of places and four persons lost their lives at Lisbon, N. H., in a rush of ice and water in the Ammonoosue River.

Probably the most destructive floods of the month occurred in the Sacramento River of California, due to prolonged and heavy rains over the upper headwaters of that river in the neighborhood of Red Bluff and Kennett, Cal., 30 and 29 inches, respectively, falling at those places during the month. Fortunately the main flood waves came out of the upper Sacramento and Stony Creek, the lower eastern tributaries not contributing largely to the flood waters.

The principal crest at Kennett occurred on the 2d as a result of four consecutive days of heavy rain at that point; 13 inches of rain having fallen in that period. The area covered by this unusually heavy fall was doubtless not great. A second and more general flood wave arose on the 9th; which, though less in volume than the first, was more general in the tributary streams.

There was some overflow in the vicinity of Red Bluff, but the greatest overflow occurred on the left bank of the river between Knights Landing and Colusa, due to the breaking up of the levees that protected Colusa Basin. Local Forecaster Taylor, of Sacramento, furnishes the statements of the number of acres flooded and the loss occasioned by the flood given by Table 2.

TABLE 2.—*Losses due to floods in the Sacramento.*

	Acres.
Total flooded area	150,000
Planted to grain	40,000
Planted to alfalfa	5,000
MONEY LOSS.	*Dollars.*
Crop, seeded	140,000
Levees	100,000
Personal property, houses, fences, etc	50,000
Live stock, cattle, sheep, and hogs	5,000
Railroads, including that due to suspension of business	50,000
Total loss	345,000
Money value saved as result of warnings	35,000

The loss in connection with crops will be much greater provided the land flooded does not drain in time to allow replanting.

The approximate loss outside of California is shown by Table 3 below.

TABLE 3.—*Flood loss and damage, February, 1915.*

State or district.	Tangible property, bridges, highways, cleaning up.	Farm property, live stock.	Crops, prospective.	Suspension of business.	Estimated saved by warnings.
Ohio Valley:					
Pittsburgh district	$50,000			$10,000	$500,000
Parkersburg district				1,000	50,000
Cincinnati district	25,000	1,500		10,000	500,000
Evansville district	1,000	5,000	$3,750	5,000	50,000
South Carolina		100	200	200	14,000
North Carolina	1,500			2,000	5,000
Connecticut Valley	11,000				
James River at Richmond, Va	100			5,000	8,000
Pearl River of Mississippi	1,600	1,500		5,300	6,000
Total	89,600	7,100	3,950	38,500	1,133,000

Hydrographs for typical points on several principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

SNOWFALL AT HIGH ALTITUDES, FEBRUARY, 1915.

Arizona.—At high elevations such as the San Francisco peaks, Bill Williams Mountain, the higher ranges of Yavapai County and the higher levels of the Graham, and the ranges still farther south, where the precipitation was wholly or mostly in the form of snow, unusual depths are reported.

In the Mogollons, the White and Blue Mountains, and over a large extent of plateau bordering thereon, there have been frequent and heavy snows, with practically no melting. As a result the snow depths at altitudes above 7,500 feet have been increased phenomenally. In the Paradise Creek section of the White Mountains snow stakes were installed some months ago at elevations ranging from 8,000 to 9,800 feet. In this section the average depth of snow on January 28, 1915, was 30 inches. On March 3, less than three weeks later, three stakes were found buried in the snow. The stakes are set vertically in the ground, the tops 90 inches above the surface. In other parts of the field there was practically 9 feet of snow on the ground. There is, therefore, vastly more snow available for runoff this season than in the past, and it is difficult to conceive that the spring melting can occur under weather conditions so unfavorable as to possibly affect the realization of the confidently expected capacity storage in the Roosevelt Reservoir this spring.—*Robert R. Briggs, Section Director.*

California.—The snowfall during the month was very light and confined to the last decade. There is more snow on the ground than at this time last year, and also more than the normal. The snow is hard and well packed and the indications are that there will be ample water for irrigation and power purposes during the coming summer.—*G. H. Willson, District Forecaster.*

Colorado.—The snowfall during February was much below the normal throughout the regions drained by the Yampa, White, and Grand Rivers. On the Gunnison watershed the distribution was irregular, the fall being somewhat above the normal in the upper drainage of the north fork and below the normal in the upper part of the trunk stream. An excess occurred in the South Platte watershed, except near the headwaters, while a slight excess occurred in the middle drainage of the Arkansas, but there was a deficit in the Lake County district, where this river has its source. In general, slightly more than the average snowfall occurred in the Rio Grande drainage area, and a moderate excess in the San Juan and southwestern areas.—*F. H. Brandenburg, Section Director.*

Idaho.—The month of February was one of light snowfall. While the precipitation was normal or above in many places, the greater part of it was in the form of rain, except in the higher mountains. The temperature was generally much above normal, resulting in rapid melting. In all parts of the State there is less than the average amount of snow, and in many places the depth is less than for years at this date. The melting thus far has caused little runoff. The snow is fairly wet, averaging about 28 per cent of its depth in water, where measurements of density have been made. The present outlook is for a decided shortage in the flow of all the streams of the State.—*Edward L. Wells, Section Director.*

Montana.—February was the fourth month with light snowfall throughout Montana. There is practical agree-